

REMARKS

By this Amendment, Applicants have amended claims 6, 8, and 9 to more appropriately define the invention. Claims 1-19 are pending.

In the Office Action, the Examiner rejected claims 6 and 8 under 35 U.S.C. § 112, second paragraph, as indefinite; rejected claims 1-5 and 7 under 35 U.S.C. § 103(a) as unpatentable over Gardner et al. (U.S. Patent No. 5,837,572) in view of Krivokapic et al. (U.S. Patent No. 6,512,273); and rejected claim 12 under 35 U.S.C. § 103(a) as unpatentable over Gardner et al. in view of Krivokapic et al., further in view of Osanai et al. (U.S. Patent No. 6,777,752). Claims 9-11 and 13-19 were objected to as dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Applicants appreciate the indication of allowable subject matter, and traverse the claim rejections for the following reasons.

In rejecting claims 6 and 8 under 35 U.S.C. § 112, second paragraph, the Examiner stated that “[i]n both claims 6 and 8, it seems applicant is performing the sub-activation before the implant is implanted but after the pre-anneal.” Office Action at 2. Applicants disagree. Claim 6 depends from claims 1 and 5 and therefore incorporates all the elements of claims 1 and 5. Claim 1 recites, inter alia,

selectively implanting impurity ions of the first conductivity type to the first gate electrode and a surface layer of the semiconductor substrate adjacent to the first insulating gate portion; [and]

...

after implanting the impurity ions of the first and second conductivity types, performing pre-annealing at a first substrate temperature.

Emphasis added. Claim 5 requires that selectively implanting impurity ions of the first conductivity type comprise:

selectively implanting the impurity ions of the first conductivity type to the first gate electrode and the surface layer adjacent to the first gate electrode; and

selectively implanting the impurity ions of the first conductivity type to the surface layer and the first gate electrode, both of which are adjacent to the first sidewall spacer.

Clearly, the two steps recited in claim 5 are performed before the pre-annealing. Claim 6 further recites performing sub-activation for the impurity ions of the first conductivity type between the two steps recited in claim 5. Therefore, the step of sub-activation is also performed before the pre-annealing. Applicants therefore respectfully submit that the Examiner's rationale for rejecting claim 6 is misplaced. Accordingly, the Examiner's rejection under 35 U.S.C. § 112, second paragraph should be withdrawn. Moreover, since claim 8 recites similar language as claim 6, Applicants also request that the rejection of claim 8 under 35 U.S.C. § 112, second paragraph should be withdrawn at least for reasons discussed above in regard to claim 6.

Applicants also traverse the rejections under 35 U.S.C. § 103(a), because a prima facie case of obviousness has not been established by the Examiner.

To establish a prima facie case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in

the prior art, and not based on applicant's disclosure. M.P.E.P. § 2143, 8th ed.,
Revision of May 2004.

The rejection of claims 1-5 and 7 is improper, at least because Gardner et al. and Krivokapic et al., taken alone or in combination, fail to teach or suggest each and every element of these claims.

Particularly, claim 1 recites, inter alia,

. . . performing pre-annealing at a first substrate temperature; and

after the pre-annealing, performing main activation for the impurity ions of the first and second types **at a second substrate temperature higher than the first substrate temperature** for a treatment period shorter than a period of the pre-annealing.

Emphasis added.

The Examiner correctly acknowledged that Gardner et al. does not teach these elements of claim 1. In an attempt to overcome the deficiencies of Gardner et al., the Examiner alleged that "Krivokapic shows a first anneal that is performed for 5-10 seconds, . . . followed by a second anneal that is performed for 2-5 seconds (col. 4, line 38-col. 5, line 40)." Office Action at 5. The Examiner apparently considered the two RTA annealing steps taught by Krivokapic et al. as corresponding to Applicants' claimed pre-annealing and main activation. Applicants traverse the Examiner's position.

Krivokapic et al. teaches that "[i]n step 63, RTA anneal is performed for 5-10 seconds at 1030-1060 C. . . . In step 90, RTA anneal is performed at 990-1010 C. for 2-5 seconds." Krivokapic et al., col. 4, l. 67 - col. 5, l. 1, and col. 5, ll. 31-32. Further, as Fig. 1 shows, step 90 is performed after step 63. In other words, Krivokapic et al. teaches a first annealing performed at a higher temperature than a second annealing. Therefore, the two annealings taught by Krivokapic et al. cannot respectfully correspond

to Applicants' claimed pre-annealing and main activation, because claim 1 requires that the main activation be performed after, and at a **higher** temperature than, the pre-annealing. Krivokapic et al. actually teaches away from claim 1 in requiring that the RTA anneal at step 90 be performed after, and at a **lower** temperature than, the RTA anneal at step 63.

Therefore, Gardner et al. and Krivokapic et al., taken alone or in combination, fail to teach or suggest at least "performing pre-annealing at a first substrate temperature; and after the pre-annealing, performing main activation for the impurity ions of the first and second types at a second substrate temperature higher than the first substrate temperature," as recited in claim 1. One skilled in the art would not have been motivated to combine the references because Krivokapic et al. in the manner proposed by the Examiner teaches away from the claimed invention. Therefore, claim 1 is patentable over Gardner et al. and Krivokapic et al. Claims 2-5 and 7 depend from claim 1 and are also patentable at least because of their dependence from an allowable base claim.

The rejection of claim 12 under 35 U.S.C. § 103(a) as unpatentable over Gardner et al., Krivokapic et al., and Osanai et al. is also improper, because Osanai et al. fails to cure the above-noted deficiencies of Gardner et al. and Krivokapic et al. with regard to claim 1, from which claim 12 depends. Osanai et al. only mentions one heat treatment, which "is performed at 800° C. to 900° C. . . . in an electric furnace . . . , and is performed at 1000° C. to 1100° C. . . . in case of rapid thermal annealing (RTA)." Osanai et al., col. 45, ll. 62-67. Osanai et al. does not teach a second annealing, and therefore fails to teach or suggest at least "performing pre-annealing at a first substrate

temperature; and after the pre-annealing, performing main activation for the impurity ions of the first and second types at a second substrate temperature higher than the first substrate temperature," as recited in claim 1.

Therefore, claim 12, which depends from claim 1, is patentable over Gardner et al., Krivokapic et al., and Osanai et al., and the rejection thereof should be withdrawn.


In view of the foregoing amendments and remarks, Applicant respectfully requests reconsideration and reexamination of this application and the timely allowance of the pending claims.

Please grant any extensions of time required to enter this response and charge any additional required fees to our deposit account 06-0916.

Respectfully submitted,

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By: 

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